REMARKS

Claims 1-28 are pending in this application. By this Amendment, claims 1 and 15 are amended. Support for the amendments to claims 1 and 15 can be found, for example, in the paragraph bridging pages 22 and 23 of the instant specification. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Information Disclosure Statement

The Office Action indicates that the references JP 54-002646 and JP 8-319214 were not considered, because they do not disclose material information as described in the instant specification. Applicants have submitted the correct references herewith in an additional Information Disclosure Statement.

Rejection Under 35 U.S.C. §103

The Office Action rejects claims 1-28 under 35 U.S.C. §103(a) over U.S. Patent No. 6,818,578 to Tachiwama ("Tachiwama") in view of U.S. Patent No. 4,226,627 to Inoue et al. ("Inoue"). Applicants respectfully traverse the rejection.

Claims 1 and 15 are directed to optical glasses, *inter alia*, (a) having a refractive index (n_d) and an Abbe number (ν_d) which are within an area surrounded by straight lines that are drawn by connecting point A (n_d=1.835, ν_d=46.5), point B (n_d=1.90, ν_d=40.0), point C, (n_d=1.90, ν_d=35.0) and point D (n_d=1.835, ν_d=38.0) in a sequence of A, B, C, D and A as border lines in x-y orthogonal coordinates shown in FIG. 1, in which X-axis is the Abbe number (ν_d) and Y-axis is the refractive index (n_d), the area including the border lines, (b) including more than 19 to 25 mass% of Ta_2O_5, and (c) having a transition temperature (Tg) of 550 to 650°C. Tachiwama does not teach or suggest such optical glasses. Inoue does not remedy the deficiencies of Tachiwama.

The Office Action asserts that Tachiwama discloses an optical glass having a refractive index of greater than 1.875 and an Abbe's number of greater than 39.5 including 3-10 wt % SiO_2, 7-15 wt % B_2O_3, 30-60 wt % La_2O_3, 0-30 wt % Gd_2O_3, 13-19 wt Ta_2O_5, and 0-1 wt % Li_2O. The Office Action relies on Inoue for its alleged suggestion that fluorides should be added to optical glasses such as disclosed in Tachiwama. Notwithstanding these assertions, Tachiwama and Inoue would not have rendered obvious the optical glasses of claims 1 and 15.

Each of claims 1 and 15 requires that the recited optical glass have a transition temperature (Tg) of 550 to 650°C. Tachiwama asserts that the disclosed glasses can have a transition temperature of less than 700°C. *See* column 2, lines 36 to 40. However, in the examples of Tachiwama, the lowest recorded transition temperature is 672°C. *See* Tachiwama, Table 3, Example 6. This lowest transition temperature of Tachiwama is outside of the ranges recited in claims 1 and 15. Moreover, this lowest transition temperature of Tachiwama is 42°C higher than the highest transition temperature (630°C) recorded in the examples of the instant application. *See* instant specification, Tables 1, 2 and 4. The highest temperature at which precision mold pressing can be conducted is determined by, for example, the heat resistances of the forming apparatus, the metal die and any coatings on the metal die, and the transition temperature of the glass used as a preform. By virtue of the interdependency of these parameters, the upper limit for the transition temperature of the glass used as the preform is considered to be between 530 and 700°C. At working temperatures near the upper limit for transition temperature, the metal die deteriorates quickly so that mass production is slowed and/or precision mold pressing cannot be performed. Accordingly, the advantage obtained by achieving the transition temperatures of the compositions recited in claims 1 and 15, relative to the transition temperatures of the compositions of Tachiwama, is a significant one.

As conceded in the Office Action, Tachiwama fails to disclose the presence of fluorides in an optical glass, as recited in claims 1 and 15. The Office Action correctly asserts that it is known to use fluorides to lower a softening temperature of glass. However, it was not known at the time of the instant invention that an optical glass having a high refractive index, low dispersivity and low transition temperature capable of practical use could be obtained by including a fluoride component. The present inventors discovered that employing particular amounts of F, Li_2O and Ta_2O_5 and particular sum quantities of Gd_2O_3, GeO_2 and Nb_2O_5 in an optical glass can result in formation of an Si-B-La system glass having a high refractive index, a low dispersivity and a low transition temperature that can be put to practical use. As it had previously been difficult to obtain low transition temperatures in Si-B-La system glasses, it was an unexpected achievement for the present inventors to obtain an optical glass having a good balance of low transition temperature (as a result of F and Li_2O) and high refractive index (as a result of Ta_2O_5) that is sufficiently stable for practical use. As Tachiwama provides no teaching or suggestion regarding particular amounts of F and particular sum quantities of Gd_2O_3, GeO_2 and Nb_2O_5, Tachiwama does not provide sufficient guidance to obtain the superior optical glasses of claims 1 and 15.

As indicated above, each of claims 1 and 15 recites the optical glasses contain "more than 19 to 25 mass% of Ta_2O_5." Tachiwama discloses a glass having a content of Ta_2O_5 of 13 to 19 mass%. *See* column 2, lines 66 to 67. Further, Tachiwama discloses that resistance to devitrification deteriorates when glass contains Ta_2O_5 in an amount of 19 mass% or more. *See* column 6, lines 14 to 17. Accordingly, Tachiwama does not teach the content of Ta_2O_5 recited in claims 1 and 15, but rather teaches away from the recited content.

Inoue does not remedy the deficiencies of Tachiwama. While Inoue is silent regarding an upper limit of refractive index of the disclosed examples, in the example of Inoue having the greatest refractive index (Example 8), the refractive index is 1.82. *See* Table 2. The Abbe

number for the glass of Example 8 of Inoue is 46.3. Thus, none of the examples of Inoue possesses a refractive index within the ranges of claims 1 and 15. Moreover, as shown in FIG. 1 of Inoue, the glasses are intended to encompass different refractive indices and dispersivities than are recited in claims 1 and 15.

It is not difficult for a skilled artisan to manufacture optical glass having lower refractive indices as in Inoue. While the Office Action asserts that it would have been obvious to employ fluorides as in Inoue to lower transition temperature and obtain the optical glasses of claims 1 and 15, Applicants submit that it would only be obvious to do so when working with optical glass having relatively low refractive indices as in Inoue. A skilled artisan would not expect success in the enterprise of adding a fluoride component to reduce transition temperature while maintaining the refractive indices and dispersivities recited in claims 1 and 15.

In addition, Inoue teaches that amounts of including Ta_2O_5 in optical glass in amount of 8% or more will deteriorate the desired optical constant of the glass. *See* column 3, lines 8 to 12. Thus, Inoue, like Tachiwama <u>teaches away</u> from optical glasses containing "more than 19 to 25 mass% of Ta_2O_5," as recited in claims 1 and 15. As neither Tachiwama nor Inoue teaches or suggests an optical glass containing more than 19 and up to 25 mass% of Ta_2O_5, the combination of references fails to teach or suggest each and every element of claims 1 and 15.

The optical glasses of claims 1 and 15 have low dispersivities (i.e., high Abbe numbers) and high refractive indices. Each of claims 1 and 15 recites that an optical constant of the recited optical glass is within a region surrounded by the points of A, B, C and D of FIG. 1. It is important to note that glasses having dispersivities and refractive indices that fall below and to the right of the line C-D in FIG. 1 (i.e., a region depicting lower refractive indices and lower dispersivities) fall outside of the scope of claims 1 and 15.

Applicants have attached an "nd-vd map" showing optical constants for optical glasses falling within claims 1 and 15 and other conventional optical glasses produced by the Assignee. The "nd-vd map" is widely used in the field of optical design and optical glass manufacturing to characterize the dispersivities and refractive indices of optical glass. As apparent from the attached nd-vd map, conventional optical glasses have a tendency to have optical constants located around a line extending from lower left to upper right on the map. A skilled artisan would assume that it is easy to obtain an optical glass having a high refractive index and high dispersivity and difficult to obtain an optical glass not having those characteristics. As can be seen from the map, the optical glasses of claims 1 and 15 defy this assumption and have refractive indices and dispersivities different from those of conventional optical glasses. The distribution of optical constants in conventional optical glasses is not the result of optical design needs, but rather the result of difficulties in manufacturing such glasses. In view of these difficulties optical glasses having the optical constants recited in claims 1 and 15 are particularly desirable.

The present inventors overcame two major problems with conventional optical glasses to obtain the glasses of claims 1 and 15. First, optical glasses having optical constants such as recited in claims 1 and 15 generally have high transition temperatures (generally around 700^0C), and thus are not amenable to precision mold pressing. Second, high devitrification temperatures of such glasses cause generation of crystals when shaping molten glass that results in extremely low yields due to devitrification or the absence vitrification.

In order to solve these problems, a skilled artisan might attempt various compositions taking into consideration the effects of each component. For example, addition of Li_2O and fluoride components might lower the transition temperature significantly. However, addition of those components is known to deteriorate stability (i.e., resistance to devitrification) of optical glass. Accordingly, in spite of the need, those of ordinary skill in the art have failed to

obtain optical glass with high refractive index and low dispersivity having a glass transition point around 650°C.

As discussed above, the present inventors unexpectedly determined that a particular amounts of fluorides, Li_2O and Ta_2O_5, and particular sum quantities of Gd_2O, GeO_2 and Nb_2O_5 result in an Si-B-La system glass with a high refractive index and a low dispersivity having a transition temperature low enough for precision mold pressing. (Of course, the amounts of the remaining components recited in claims 1 and 15 are also important to the properties of the recited glasses). That is, the present inventors overcame difficulties appreciated by those skilled in the art to obtain an Si-B-La system glass having a high refractive index, a low dispersivity and a low transition temperature that can be put to practical use.

Claims 1 and 15 would not have been rendered obvious by Tachiwama and Inoue. Claims 2-14 and 16-28 depend from claims 1 and 15, respectively, and thus also would not have been rendered obvious by Tachiwama and Inoue. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-28 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

William P. Berridge
Registration No. 30,024

Jacob A. Doughty
Registration No. 46,671

WPB:JAD/hs

Attachment:
"nd-vd" Map

Date: March 14, 2006

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
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Reference Material 1

OHARA® OPTICAL GLASS